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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/807,921	03/24/2004	Osamu Shinkawa	9319A-000743	4028

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HARNESS, DICKEY & PIERCE, P.L.C.

P.O. BOX 828

BLOOMFIELD HILLS, MI 48303

EXAMINER

HUFFMAN, JULIAN D

ART UNIT

PAPER NUMBER

2853

DATE MAILED: 06/08/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/807,921

Applicant(s)

SHINKAWA ET AL.

Examiner

Julian D. Huffman

Art Unit

2853

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-43 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 27-35 is/are allowed.
- 6) ☒ Claim(s) 1-6, 8, 9, 11-14, 16-21, 24-26, 36-41 and 43 is/are rejected.
- 7) ☒ Claim(s) 7, 10, 15, 22, 23 and 42 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 04 August 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
- 1) ☒ Certified copies of the priority documents have been received.
  - 2) ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 3/24/04, 10/14/04.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_.

## **DETAILED ACTION**

### ***Information Disclosure Statement***

1. The information disclosure statement filed 14 October 2004 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document; each non-patent literature publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered.

### ***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-6, 8, 9, 11-14, 16-21, 24-26, 36-41 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fukano in view of Nagashima (U.S. 4,625,220).

Fukano discloses:

With regards to claims 1, 3 and 8, a droplet ejection apparatus (fig. 1) comprising:

a droplet ejection head including (fig. 3):

a diaphragm (26);

an actuator (9) which displaces the diaphragm;

a cavity (23) filled with a liquid, an internal pressure of the cavity being increased

and decreased in response to displacement of the diaphragm; and

a nozzle (24) communicated with the cavity, through which the liquid in the cavity is ejected in the form of droplets in response to the increase and decrease of the internal pressure of the cavity;

a driving circuit (fig. 1) which drives the actuator;

ejection failure detecting means (fig. 1, oscillation waveform detection circuit, any one of elements 3, 7, 8, 11, 10 and 16-21) for detecting a residual vibration of the diaphragm in the droplet ejection head and detecting an ejection failure of droplets on the basis of a vibration pattern of the detected residual vibration of the diaphragm (page 6, line 17-page 7, line 2); and

switching means (transistors 7 or 8) for switching a connection of the actuator from the driving circuit to the ejection failure detecting means after carrying out a droplet ejection operation by driving the actuator (immediately after ejection, transistors 7 and 8 receive a signal and are switched on thereby connecting the actuator to the detection means).

With regards to claim 5, the droplet ejection apparatus as claimed in claim 3, wherein the switching means carries out the switching operation in response to a predetermined switching signal (the signal which turns on the transistors).

With regards to claim 6, the droplet ejection apparatus as claimed in claim 5, further comprising switching control means for controlling the switching means that corresponds to the droplet ejection head (the controller which supplies the driving pulses to the actuator constitutes the switching control means).

With regards to claim 9, wherein, when the switching means is switched by the switching control means to carry out the switching operation, the ejection failure detecting means detects the ejection failure in the determined droplet ejection head (page 6, line 17-page 7, line 2).

With regards to claim 11, the droplet ejection apparatus as claimed in claim 1, wherein the ejection failure detecting means detects the ejection failure of the droplets at either timing of the droplet ejection operation in a flushing process for the nozzle of the droplet ejection head selected by the ejection selecting means or timing of the droplet ejection operation during a printing operation (droplet ejection).

With regards to claim 12, the droplet ejection apparatus as claimed in claim 1, wherein the ejection failure detecting means includes judging means for judging presence or absence of the ejection failure of the droplets in the droplet ejection head on the basis of the vibration pattern of the residual vibration of the diaphragm (constitution).

With regards to claim 13, the droplet ejection apparatus as claimed in claim 12, wherein the judging means judges a cause of the ejection failure in the case where it is judged that the ejection failure of the droplets is present in the droplet ejection head (page 7, lines 1-2).

With regards to claim 14, the droplet ejection apparatus as claimed in claim 13, wherein the vibration pattern of the residual vibration of the diaphragm includes a cycle of the residual vibration (page 6, lines 17-20).

With regards to claim 16, a storage means for storing the judgement result judged by the judging means (page 8, lines 20-25).

With regards to claim 17, the droplet ejection apparatus as claimed in claim 1, wherein the ejection failure detecting means includes an oscillation circuit and the oscillation circuit oscillates in response to an electric capacitance component of the actuator that varies with the residual vibration of the diaphragm (page 6, line 17-page 7, line 2).

With regards to claim 18, the droplet ejection apparatus as claimed in claim 17, wherein the ejection failure detecting means includes a resistor element connected to the actuator, and the oscillation circuit forms a CR oscillation circuit based on the electric capacitance component of the actuator and a resistance component of the resistor element (page 4, lines 22-25).

With regards to claim 19, the droplet ejection apparatus as claimed in claim 17, wherein the ejection failure detecting means includes an F/V converting circuit (8, 19-21 and 3, page 7, lines 13-15) that generates a voltage waveform in response to the residual vibration of the diaphragm from a predetermined group of signals generated based on changes in an oscillation frequency of an output signal from the oscillation circuit (figs. 4-6).

With regards to claim 20, the droplet ejection apparatus as claimed in claim 19, wherein the ejection failure detecting means includes a waveform shaping circuit (11) that shapes the voltage waveform in response to the residual vibration of the diaphragm generated by the F/V converting circuit into a predetermined waveform (page 7, lines 10-11).

With regards to claim 21, the droplet ejection apparatus as claimed in claim 20, wherein the waveform shaping circuit includes:

DC component eliminating means for eliminating a direct current component from the voltage waveform of the residual vibration of the diaphragm generated by the F/V converting circuit (11, page 7, lines 11-13); and

a comparator that compares the voltage waveform from which the direct current component thereof has been eliminated by the DC component eliminating means with a predetermined voltage value (page 8, lines 20-25); and

wherein the comparator generates and outputs a rectangular wave based on this voltage comparison (processor compares the detected timing to a normal timing to determine a malfunction, processors are digital and operate by way of rectangular waves representing digital bit data).

With regards to claim 24, the droplet ejection apparatus as claimed in claim 1, wherein the actuator includes an electrostatic actuator (piezoelectric actuators are electrostatic).

With regards to claim 25, the droplet ejection apparatus as claimed in claim 1, wherein the actuator includes a piezoelectric actuator having a piezoelectric element and using a piezoelectric effect of the piezoelectric element (element 9).

With regards to claim 26, the droplet ejection apparatus as claimed in claim 1, wherein the droplet ejection apparatus includes an ink jet printer (title).

With regards to claim 36, a method of detecting and judging an ejection failure in a droplet ejection head (fig. 3) of a droplet ejection apparatus, the droplet ejection apparatus including a driving circuit (fig. 1), a detecting circuit (any one of elements 3, 7, 8, 11, 10 and 16-21) and a droplet ejection head including a diaphragm (26), an actuator (9), a cavity (23) and a nozzle (24), the method comprising the steps of:

selecting the nozzle (24) of the droplet ejection head in the droplet ejection head through which a droplet is to be ejected;

driving the actuator with the driving circuit to displace the diaphragm (page 5, line 17-page 6);

carrying out a droplet ejecting operation through the nozzle (page 5, line 17-page 6);

switching a connection of the actuator from the driving circuit to the detecting circuit after carrying out the droplet ejection operation (page 6, lines 17-20, fig. 2, transistor 7 or 8 is switched on by a signal after the piezoelectric element is displaced);

detecting a residual vibration of the diaphragm with the detecting circuit (page 6, lines 17-23); and

detecting an ejection failure of the droplets on the basis of a vibration pattern of the detected residual vibration of the diaphragm (page 7, line 2).

With regards to claim 40, the method as claimed in claim 36, wherein the ejection failure detecting step includes detecting the ejection failure of the droplets at either timing of the droplet ejection operation in a flushing process for the nozzle of the droplet ejection head in question or timing of the droplet ejection operation during a printing operation (timing during a printing operation).

With regards to claim 41, the method as claimed in claim 36, further comprising the steps of:

judging presence or absence of the ejection failure of the droplets in the droplet ejection head on the basis of the vibration pattern of the residual vibration of the diaphragm (page 6, lines 17-23); and



judging a cause of the ejection failure in the case where it is judged that the ejection failure of the droplets is present in the droplet ejection heads (page 7, line 2).

With regards to claim 43, storing the judgement result judged in the judging step into a storage section (page 8, lines 20-25).

Fukano does not disclose the droplet ejection apparatus with a plurality of heads, including a plurality of the circuitry as claimed.

Nagashima discloses a plurality of heads, each head having detection circuitry to detect an air bubble or the like in a piezoelectric print head (column 4, lines 52-62).

It would have been obvious to one having ordinary skill in the art at the time of the invention to incorporate the teachings of Nagashima into Fukano, thereby providing plural print heads with plural structure as claimed, for the purpose of enabling printing in multiple colors.

With regards to claims 2 and 4, the limitation that the ejection is carried out sequentially for each head, or substantially simultaneously is not seen to further limit the structure of the droplet ejection apparatus, which is capable of being operated in the manner claimed.

#### ***Allowable Subject Matter***

4. Claims 7, 10, 15, 22, 23 and 42 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

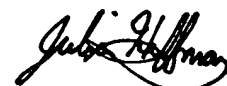
Claims 27-35 are allowed.

**Conclusion**

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Julian D. Huffman whose telephone number is (571) 272-2147. The examiner can normally be reached on 10:00a.m.-6:30p.m. Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Meier can be reached on (571) 272-2149. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

  
Julian D. Huffman  
1 June 2006